

## **Guidelines for the Toxicological Investigation of Drug-Facilitated Crimes**

### **1 Scope**

This procedure serves as a general guideline for the toxicological investigation of drug-facilitated crimes (DFC) in the Chemistry Unit of the FBI Laboratory. DFC investigation may include cases in which a sexual assault is alleged to have occurred, commonly known as drug-facilitated sexual assault (DFSA). It is important to note that no two cases are alike, each having its unique circumstances and history which affect the direction of the toxicological investigation. However, the following serves as a suggested approach in the analysis of submitted specimens. This document applies to Chemistry Unit case working personnel who perform toxicology analyses.

### **2 Background**

One of the more difficult problems for analytical and forensic toxicologists investigating these crimes is the number of different drugs that have been used to commit DFC. Table 1 lists the common symptoms that victims of this crime have reported. Many different drugs can cause the symptoms listed in Table 1. Table 2 lists examples of drugs that have been reportedly used in DFC.

Table 1: Symptoms Described by Victims of DFC

Confusion	Reduced Inhibition
Drowsiness	Impaired Memory
Dizziness	Reduced Blood Pressure
Nausea	Decreased Heart Beat
Lack of Muscle Control	Loss of Consciousness
Impaired Judgment	

Table 2: Example Drugs Reportedly Used to Commit DFC

Ethanol	Barbiturates
GHB, GBL, and 1,4-Butanediol	Zolpidem
Benzodiazepines	Ketamine
	Opiates
Clonazepam	Sedative Antihistamines
Lorazepam	Hallucinogens
Alprazolam	Sedative Antidepressants
Triazolam	Chloral Hydrate
Chlordiazepoxide	Sedative Muscle Relaxants
Diazepam	Scopolamine
Temazepam	Herbal Sedatives
Flunitrazepam	

It is very important for the examiner to get a complete history of the case. Table 3 lists information that should be obtained and evaluated before beginning the toxicological analysis.<sup>1</sup>

Table 3: Questions to ask investigators of DFC cases

1	What symptoms did the victim describe?
2	How long was the victim's memory impaired?
3	What specimens were collected?
4	How much time passed between the alleged drugging and the collection of the specimen(s)?
5	Did the victim consume any ethanol? How much?
6	Did the victim take any drugs (recreational, herbal, prescription, or over-the-counter)? How much?
7	How many times did the victim urinate prior to the collection of a urine specimen?
8	What drugs does the suspect(s) have ready access to?
9	What are the suspect's hobbies / occupation?

After obtaining such a history, it may steer the toxicological investigation in a particular direction. This may help alleviate the time-consuming analyses typically required in a DFC investigation.

<sup>1</sup> Allow the criminal investigation to drive the toxicological investigation, not *vice versa*. The *DFC Information Collection Worksheet* (Appendix A) may be useful in gathering this information.

### **3 Specimens**

#### **3.1 The Best Specimen - Urine**

The more quickly a specimen can be obtained, the better the chances of detecting a drug in a biological specimen. This is very important in cases of DFC. As a general rule, a urine specimen (~50 mL) should be obtained within 120 hours (5 days) of the alleged drugging. Urine specimens allow for a longer window of detection of drugs commonly used in these crimes. Therefore, urine is usually considered "the best" specimen for most DFC cases. Analytes such as GHB and ethanol are rapidly excreted from the body, so testing for these compounds will not usually be performed if more than 12 hours have elapsed between the incident under investigation and the collection of the urine specimen.

#### **3.2 Blood Specimens**

In addition to the urine specimen, a blood specimen (~10 mL) should be obtained if the drugging occurred within the prior 24 hours. Blood may be tested if more than 24 hours elapse between the incident and the collection time to be able to better interpret the significance of positive urine findings, or if target drugs are known to have longer half lives. These specimens should be properly preserved so as to prevent putrefaction. Sodium fluoride and/or potassium oxalate are the preferred preservatives. It is recommended that, when possible, blood specimens only be analyzed for drugs or metabolites identified in the related urine specimen.

#### **3.3 Hair Specimens**

Hair would appear to be a logical specimen choice following a suspected DFC, particularly when there has been a delay in reporting the incident. However, there are many limitations as to the usefulness of hair specimens in these cases.

The first limitation is that most published methods for drug testing of hair samples are designed to detect chronic drug use in an individual. Until recently, drugs that have been identified in hair are those that are generally consumed in relatively high doses. Many of the drugs listed in Table 2 are low-dose formulations. Thus, there is very little drug available to incorporate into the hair. Additionally, most of these cases involve a one-time exposure to the drug.

The next issue is that hair is not conducive to comprehensive drug screens. Testing for a few drugs or drug classes may consume the entire available hair sample. In addition, hair cannot be used to screen for the most commonly encountered drug used to facilitate rape -- alcohol. Therefore, it is imperative to have a good idea as to what the likely drugging agent(s) is/are prior to the hair analysis.

Of course, hair length should also be considered. Human hair grows at a rate of approximately one centimeter per month. If the victim has short hair or there is a delay of months in collection of the hair sample, evidence of the drugging may have been removed with his/her last hair cut. It takes about two weeks for drugs to begin to appear in the hair above the scalp. Hair should be cut by isolating an approximately pencil-width section of head hair from the victim using rubber bands, ensuring that the end closest to the scalp is clearly marked. The hair should be cut close to the scalp and placed into a paper envelope.

### **3.4 Other Specimens**

As Table 1 indicates, nausea and vomiting are common symptoms of many of the drugs related to DFC. These drugs take time to completely absorb into the blood stream after ingestion. When a victim vomits shortly after ingestion of a drug, the substance may not have had an opportunity to completely absorb into the blood stream. Thus, the vomitus may contain a significant amount of the drugging agent so collection and analysis of this specimen should be assessed in these cases.

If the vomitus has dried prior to collection, the article that contains the vomitus should be submitted to the laboratory for testing. If it has not dried, it should be carefully transferred into a clean container, such as a urine collection cup.

There are other stains that may be discovered in these cases that should be collected for toxicological testing. Occasionally, the victim may release his/her bladder and a urine stain may be present on bedding materials or clothing. Also, there may be stains on items as a result of sweat as well as vaginal or rectal bleeding. If these stains are large enough, these items may also be analyzed for many of the same drugs and metabolites that would be found in a traditional urine or blood specimen. Analyzing an unstained portion of the stained material is recommended to aid with interpretation of results.

Other important evidence may include beverages, cups, plates, or containers in which the drug is suspected to have been delivered. When analysis of these items reveals a DFC drug, biological specimen analyses should be targeted toward these findings.

## **4 Analysis**

### **4.1 Routine Drugs**

Obtaining answers to the questions in Table 3 narrows down the likely candidates of drugs to search for in a given case. Whenever a likely candidate is uncovered, that drug and/or its primary biotransformation product should be targeted in a sensitive analysis.

Unfortunately, many DFC investigations do not reveal a likely drug. Then the toxicological investigation must incorporate screens for "routine" DFC drugs, as the case history dictates. Table 4 contains drugs that should be considered as part of a routine DFC screen in the FBI Laboratory.

Table 4: Routine DFC Drugs

Ethanol	Opioids:**
Gamma Hydroxybutyrate	Heroin
Gamma Butyrolactone**	Morphine
1,4-Butanediol**	Codeine
Benzodiazepines:**	Hydrocodone
Alprazolam	Hydromorphone
Bromazepam	Oxycodone
Chlordiazepoxide	Fentanyl
Chlorazepate	Methadone
Estazolam	Barbiturates:
Flurazepam	Amobarbital
Midzolam	Butalbital
Nitrazepam	Phenobarbital
Triazolam	Pentobarbital
Zolpidem**	Secobarbital
Amphetamines:	Sedative Antidepressants:**
Amphetamine	Amitriptyline
Methamphetamine	Desipramine
Methylenedioxyamphetamine	Citalopram
Methylenedioxymethamphetamine	Sedative Antihistamines:
Cocaine**	Diphenhydramine
Marijuana**	Brompheniramine
Cyclobenzaprine	Chlorpheniramine
Carisoprodol**	Doxylamine
Ketamine**	
Scopolamine	

\*\*Screens for these drugs should include major metabolites in addition to the parent drug.

## 4.2 Non-routine Drugs

At times the toxicological investigation may warrant a more comprehensive analysis. It may become necessary to perform targeted analyses for some non-routine DFC drugs. Table 5 lists the drugs that should be considered as part of a non-routine DFC screen in the FBI Laboratory.

Table 5: Non-routine DFC Drugs

Anticonvulsants:**	Sedatives :	Hallucinogens :
Chloral Hydrate	Clonidine	p-Methoxyamphetamine
Ethchlorvynol	Zolazepam	Tiletamine
Valproic Acid		

\*\*Screens for these drugs should include major metabolites in addition to the parent drug.

### 4.3 Results

The percentage of positive findings in cases of DFC is not high. There are a number of factors that may contribute to the low number of findings. First, victims often do not come forward immediately. Every hour that passes between the drugging and the collection of specimen decreases the chance of detecting many of the drugs used in these crimes.

Next is the fact that many laboratories are relying on analytical techniques that are not sensitive enough to determine if a person was drugged. While these techniques are adequate to determine if an individual overdosed or was driving under the influence of one of these drugs, they are far from adequate when addressing whether a victim was drugged to the point of unconsciousness many hours to days prior to the collection of a specimen. Improving methodologies to lower the detection limits for certain drugs should result in an increase in the number of positive findings in these cases. The Society of Forensic Toxicologists Drug-Facilitated Crimes Committee has recommended maximum detection limits for common DFC drugs and metabolites in urine sample.

Another cause for the lack of a "positive" finding may be that an inappropriate specimen is taken (e.g., blood with no urine).

These factors should be taken into consideration when reviewing results performed both in the FBI Laboratory and from other laboratories.

### 5 Equipment/Materials/Reagents

Not applicable.

### 6 Standards and Controls

Not applicable.

## **7 Sampling**

Not applicable.

## **8 Procedure**

Not applicable. This document is meant to serve only as a guideline for analyzing evidence from suspected DFC cases. Follow appropriate Toxicology SOPs for specific procedures.

## **9 Calculations**

Not applicable.

## **10 Measurement Uncertainty**

Not applicable.

## **11 Limitations**

Not applicable.

## **12 Safety**

Not applicable.

## **13 References**

LeBeau, M.A.; Andollo, W.; Hearn, W.L.; et al. *J For Sci.*, 1999 227-229.

*Analytical Procedures for Therapeutic Drug Monitoring and Emergency Toxicology.*  
2nd edition, PSG Publishing Company: Littleton, Massachusetts, 1987.

*Drug-Facilitated Sexual Assault: A Forensic Handbook.*; LeBeau, M.A. and Mozayani, A., Eds.; Academic Press: London, 2001.

LeBeau, M., Montgomery, M., Phipps, R., and Miller, M. *Journal of Analytical Toxicology*, 2000, Vol 24.

LeBeau, M., Miller, M., and Levine, B. *Forensic Science International*, 2001, 119(2).

Society of Forensic Toxicologists Drug-Facilitated Crimes Committee. *Recommended Minimum Detection Limits for Common DFC Drugs and Metabolites in Urine Samples* (Accessed July 30, 2018 at [http://soft-tox.org/files/MinPerfLimits\\_DFC2017.pdf](http://soft-tox.org/files/MinPerfLimits_DFC2017.pdf)).

Society of Forensic Toxicologists Drug-Facilitated Sexual Assault Committee. *DFC Fact Sheet* (Accessed July 30, 2018 at [http://soft-tox.org/files/DFC\\_Fact\\_Sheet.pdf](http://soft-tox.org/files/DFC_Fact_Sheet.pdf)).

*FBI Laboratory Safety Manual.*

*Chemistry Unit Quality Assurance Manual.*

*FBI Laboratory Operations Manual.*

*FBI Laboratory Quality Assurance Manual.*



Rev. #	Issue Date	History
1	03/11/11	In Section 3.1, updated the urine specimen collection time to 120 hours and that GHB and ethanol testing are typically capped at 12 hours post incident. Removed comments in Section 3.3 that stated hair testing in DFSA cases as a technique of the future. In Section 4.1, added a comment about recommended controls and validation. Also added high resolution mass spectrometry to 4.1. Updated Tables 4 and 5 with drugs routinely screened for and those considered non-routine. Added SOFT DFSA Fact Sheet to references. Removed all references to DFSA Positive Control from Sections 5, 6 and 7. Added Appendix A, the DFSA Information Collection Worksheet and referenced in a footnote in Section 2.
2	08/20/18	Removed footers. Removed Calibration (formerly Section 7), and renumbered. Rephrased "Measurement Uncertainty". Retitled document to align with current SOFT language. Updated language in Sections 1, 4.4, 13, and information sheet (form) to reflect SOFT language where appropriate. Replaced DFSA with DFC throughout document. Updated 3.2 to clarify blood testing. 3.4: added sweat as a matrix and added language about testing unstained portions. 13: removed references to specific TOX SOPs. 1: Updated scope statement for personnel. 3.3: removed non-metric units of measurement and changed collection to diameter specification. 2: updated language. 8: removed "subunit". Reformatted Table 3. Updated 3.1 urine volume to 50mL. Deleted 4.1 and renumbered. Updated Table 4. Added sentence to Section 4.3

### **Approval**

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